REMARKS

Reconsideration of this Application is respectfully requested.

Upon entry of the foregoing Amendment, claims 1-5, 7-14 and 17-23 are pending in the application, with claims 1, 22 and 23 being the independent claims.

Objections to the Claims

In the Action on page 21, claims 22 and 23 are objected to for minor informalities. Applicants have amended claims 22 and 23 to recite "a computer-implemented method" as suggested by the Action. Applicants respectfully request that the objection be withdrawn.

Rejections under 35 U.S.C. § 103

I. In the Action at pages 3-10, claims 1-5, 7-10, 12, 14 and 18-22 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,701,400 to Amado (hereinafter "Amado") in view of "Dempster-Shafer Reasoning for Medical Image Recognition, IEEE Computer Society (U.S.), Volume-Conference 3, Los Alamitos, CA, November 1991, pages 480-487 to Lin et al. ("Lin"), and in further view of "Consensus in a multi-expert system" to Ng et al. ("Ng"). Applicants respectfully traverse the rejection.

Claim 1 recites a system operative to recognize objects in content comprising: a blackboard comprising ***a plurality of experts***, and data comprising original input data and data created by processing of any of said plurality of experts, and ***a controller operative to control said experts***; a ***belief model***, coupled to said controller, comprising a set of beliefs and probabilities associated with each belief of said set of beliefs, wherein said belief model comprises a set of rules deduced from a learning system, said learning system comprising truth data files for deducing said set of beliefs, probabilities and shadow objects, a learning system controller and a statistics space controlled by said learning system controller, wherein said set of rules describes how different classes recognized by said learning system are related to each other spatially and physically; a belief network, coupled to said controller; and ***a relations subsystem, coupled to said controller***.

The Action states that Amado fails to teach a belief model, coupled to said controller, comprising a set of beliefs and probabilities associated with each belief of said set of beliefs, wherein said belief model comprises a set of rules deduced from a learning system, said learning system comprising truth data files for deducing said set of beliefs, probabilities and shadow objects, a learning system controller and a statistics space controlled by said learning system controller, wherein said set of rules describes how different classes recognized by said learning system are related to each other spatially and physically; a belief network, coupled to said controller. In addition to not teaching this element of claim 1, Amado fails to teach at least three other limitations of claim 1.

First, Amado fails to teach a blackboard comprising **a plurality of experts**. Amado, in columns 2-5, section 2, discusses many types of conventional expert **systems**, and their uses, and tools with which to build an expert system, but does not teach or disclose a blackboard system comprised of a plurality of experts. An expert system is not the same as an expert. The definition for expert system used in Amado makes no reference to one or more experts. See, Amado, col. 2, ll. 52-65. In contrast, the plurality of experts of claim 1 may be a group of specialized functions or programs that perform operations on the image data. These experts can be any kind of processing. The principles the different experts operate on can be similar or they can be completely different. Even the languages used to implement the experts can vary. In other words, the experts can be completely heterogeneous, which is one of the main strengths of the Blackboard architecture, its ability to bring together disparate types of processing in order to solve a common problem. See p. 13 line 20 – p. 14, line 8. Therefore, Amado fails to teach a blackboard comprised of a plurality of experts.

Second, Amado fails to teach a **controller operative to control the experts**. The controller in col. 77 of Amado cited in the Action is not a controller operative to control the experts. Instead, the "controller" of Amado acts to control various commercial products to act as a user interface or to modify the user interface for displaying results or program options. See Amado, col. 77, ll. 2057. There is no discussion of controlling experts, and as noted above, Amado does not disclose experts. In contrast, the controller of claim 1 coordinates which expert contributes to a problem-solving exercise. For example, a controller may be made up of code that takes care of choosing which

experts are to be executed, and of scheduling and executing those experts. It may also perform the chores of gathering the input data for the experts, placing the output of the experts on the appropriate object class *blackboards*, keeping the belief network up to date, and of checking for duplicate objects. The controller may make extensive use of the belief model to make decisions governing which experts can be run and when to run them. See specification, p. 17, ll. 4-9. Therefore, Amado does not teach or disclose a controller operative to control the experts.

Third, Amado does not teach or discuss a **relations subsystem coupled to the controller**. Instead, the portion of Amado cited by the reference teaches maintaining algorithms, and relationships among files and database fields, even if weighting factors change in order to preserve the preferred embodiment. Amado, col. 96, ll. 52-61. There is no discussion of a relations subsystem coupled to a controller. In contrast, the spatial relation subsystem of claim 1 may be responsible for determining how different objects returned by the experts are related to each other. Each time a new object is instantiated in one of the object class blackboards, the belief model can be used to determine with which other object classes it may have significant spatial relations and what those relations might be. It is also possible to add new relations to the spatial relation subsystem. See specification, p. 11, l. 24- p. 12, l. 9. Therefore, Amado does not teach or disclose a relations subsystem coupled to the controller.

Further, Lin fails to overcome the deficiencies of Amado. As stated in Applicant's Appeal Brief, Applicants respectfully note that Lin fails to teach or suggest at least three elements of claim 1.

First, Lin, like Amado, also does not disclose or teach a blackboard comprising a ***plurality of experts***. Lin does state that a "blackboard model is composed of three major components: knowledge sources, blackboard data sources, and control." Lin, p. 482, section 4, last sentence.

Lin describes the knowledge sources as including knowledge of: 1) sensor characteristics, (2) anatomical structures, and (3) procedures of image processing and analysis. Lin, p. 482, sect. 4.1. The knowledge of (1) sensor characteristics of Lin includes assignments of belief intervals to fuzzy variables that represent the visibility of five types of structures to be recognized from a medical image. Lin, p. 482, sect. 4.1.2. The knowledge of (2) anatomical structures of Lin includes

construction of a knowledge base of high level abstractions (e.g. bone, white matter, ventricle) and "techniques to correlate" primitive features, e.g. curves, to the knowledge base. Lin, p. 483, sect. 4.1.3. The techniques to correlate include the construction of analyzers that provide beliefs about the primitive features. The knowledge of (3) image processing and analysis refers to a segmentation algorithm that partitions an input image into regions and computes features of each region. Lin, p. 482, sect. 4.1.1. None of these "knowledge sources" are the plurality of experts as claimed in claim 1.

In contrast, the plurality of experts of claim 1 may be a group of specialized functions or programs that perform operations on the image data. These experts can be any kind of processing. The principles the different experts operate on can be similar or they can be completely different. Even the languages used to implement the experts can vary. In other words, the experts can be completely heterogeneous, which is one of the main strengths of the Blackboard architecture, its ability to bring together disparate types of processing in order to solve a common problem. See p. 13 line 20 – p. 14, line 8. Therefore, Lin does not disclose or teach a blackboard comprising a plurality of experts.

Second, along with Amado, Lin also fails to teach a belief model, comprising a set of beliefs and probabilities associated with each belief of said set of beliefs, wherein said belief model comprises a set of ***rules deduced from a learning system***. The cited portion of Lin discloses that rules in the proposed medical imaging recognition system are represented in the form of a multivariate belief function. Lin states further that the rules for characterizing spatial relationships among anatomical structures are **predefined**. See Lin page 483, section 4.1.3, "Spatial Relationship." These pre-defined rules are therefore not **deduced** from a learning system. Lin does not discuss how any other rules that may be used by its system are obtained. In contrast, the belief model of Applicants' invention includes a set of rules deduced by the learning system, which describes how the different object classes that the recognition system can recognize are related to each other both spatially and statistically. All of the rules are **deduced** from a body of truthed training data provided to the learning system. See page 19, lines 7-10. Therefore, Lin fails to teach a belief model, comprising a set of beliefs and probabilities associated with each belief of said set of beliefs, wherein said belief model comprises a set of rules deduced from a learning system.

Third, Lin fails to teach a learning system comprising ***truth data files for deducing*** said set of beliefs, probabilities and ***shadow objects***. Shadow objects provide a method of identifying objects that do not have specific recognition experts. See, e.g., page 11, lines 10-13. Instead, Lin teaches a system that can recognize only a **finite** number of **known** element types, i.e. body parts, such as, e.g. a liver or a lung. See Lin p. 482, section 4, 1st paragraph. There is no discussion in Lin of how its system may deal with an unknown object. In contrast, the truth data files of Applicants' invention can allow the system to learn to recognize new, unknown objects by deducing a set of beliefs, probabilities and shadow objects. A truth data file can contain, for example, for each object identified in the image: the object's class id, its bounding box's position and size, and a flag to indicate whether or not the object is a shadow object. See, e.g., page 27, lines 19-21. Therefore, Lin fails to teach a learning system comprising truth data files for deducing the set of beliefs, probabilities and shadow objects.

Further, Ng, alone or in combination, fails to overcome the deficiencies of Amado and Lin. Ng fails to teach at least two limitations of claim 1.

First, Ng does not teach a **belief model**, coupled to said controller, comprising a set of beliefs and probabilities associated with each belief of said set of beliefs, wherein said belief model comprises a **set of rules deduced from a learning system**, said learning system comprising **truth data files for deducing said set of beliefs**, probabilities and **shadow objects**, a learning system controller and a statistics space controlled by said learning system controller, wherein said **set of rules describes how different classes recognized by said learning system are related to each other spatially and physically**. The discussion in Ng is directed more toward whether a multiple knowledge-base system (MKBS) is possible and how to achieve consensus among the expert systems that make up an MKBS. There is no mention of a belief model, or any specifics about any existing embodiments. To the extent that beliefs and probabilities are discussed, the discussion is focused on the construction of a confidence matrix. See, Ng, section 4.1. Ng does not discuss deducing rules from a learning system, deducing beliefs and shadow objects from a learning system, or rules that describe how recognized classes are related to each other spatially and physically.

Second, Ng does not teach a **relations subsystem coupled to the controller**. There is no discussion in Ng of a relations subsystem, or of relating objects from its experts systems to each other. Therefore, Ng does not teach or suggest a belief model, or a relations subsystem as recited in claim 1.

The Action asserts that it would have been obvious to modify Amado with Lin and Ng to avoid exhaustive enumeration of evidence combination and improve system performance. Applicants respectfully disagree. Modifying Amado with Lin and Ng would result in a system without a belief model. Further, the Amado reference is directed to a system that deals with business related data, where the data is analyzed according to a set of rule and presented to the user. Ng and Lin are directed to more traditional expert systems. Amado does not process image data, has no ability to infer objects or relationships for which it has not been programmed, and none of the systems in any of Amado, Lin, or Ng are able to learn to recognize objects for which they are not specifically programmed. Therefore, one skilled in the art would not have been motivated to combine Amado, Lin and Ng to obtain the invention as recited in claim 1.

Therefore, because none of the references, alone or in combination, teach or suggest all of the elements of claim 1, and because one skilled in the art would not have motivated to combine the references, the Action has failed to present a prima facie case of obviousness for claim 1. Claim 1 is therefore allowable, and Applicants respectfully request that the rejection be withdrawn.

Claims 2-5, 7-10, 12, 14 and 18-21 depend from Claim 1 and are allowable as being dependent from an allowable claim.

Claim 22 recites elements similar to those recited in claim 1, and is allowable for at least the reasons given above with respect to claim 1.

II. In the Action at pages 11-13, claim 11 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Amado in view of Lin and in further view of "Special Issue on Spatial Database Systems: Qualitative Representation of Spatial Knowledge in Two-Dimensional Space" by Papadias et al ("Papadias"). Applicants respectfully traverse the rejection.

Claim 11 is dependent on claim 1, and is allowable as being dependent from an allowable claim. Further, Papadias fails to overcome the deficiencies of the combination of Amado and Lin. While Papadias discloses concepts of spatial relationships, it does not disclose a blackboard comprised of a plurality of experts. Papadias also does not disclose a controller, a belief model, or a relations subsystem as recited in claim 1. Therefore, the combination of Papadias with Amado and Lin does not teach, disclose, or render obvious the elements of claim 11. Claim 11 is therefore allowable, and Applicants respectfully request that the rejection be withdrawn.

III. In the Action at pages 13-16, claims 12-13 are rejected 35 U.S.C. § 103(a) as being unpatentable over Amado in view of Lin, in view of Ng and in further view of "Logical design for temporal databases with multiple granularities" to Wang et al. ("Wang"). Applicants respectfully traverse the rejection.

Claims 12 and 13 are dependent on claim 1, and are allowable as being dependent from an allowable claim. Further, Wang fails to overcome the deficiencies of the combination of Amado, Lin and Ng. Wang discusses ways to implement temporal relationships among data stored in a database. Wang does not disclose any features of a blackboard system comprising a plurality of experts, or a controller operative to control the experts. Wang also does not disclose a belief model as recited in claim 1. Therefore, the combination of Wang with Amado, Lin, and Ng does not teach, disclose, or render obvious the elements of claims 12 or 13. Claims 12-13 are therefore allowable, and Applicants respectfully request that the rejection be withdrawn.

IV. In the Action at pages 16-19, claim 17 is rejected 35 U.S.C. § 103(a) as being unpatentable over Amado in view of Lin, in view of Ng and in further view of U.S. Patent No. 5,974,549 to Golan ("Golan"). Applicants respectfully traverse the rejection.

Claim 17 is dependent on claim 1, and is allowable as being dependent from an allowable claim. Further, Goaln fails to overcome the deficiencies of the combination of Amado, Lin, and Ng. Golan discloses a method for allowing downloaded software components to execute securely on a computer. While Golan mentions stub functions in the context of intercepting software code calls to subroutines not in a provided application program interface, the use of stub functions in Golan has

nothing to do with the process of integrating a new expert into an existing blackboard system comprised of a plurality of experts. Golan also does not disclose a controller, a belief model, or a relations subsystem as recited in claim 1. Therefore, the combination of Golan with Amado, Lin, and Ng does not teach, disclose, or render obvious the elements of claim 17. Claim 17 is therefore allowable, and Applicants respectfully request that the rejection be withdrawn.

V. In the Action at pages 19-21, claim 23 is rejected 35 U.S.C. § 103(a) as being unpatentable over Amado in view of Golan in further view of Lin. Applicants respectfully traverse the rejection.

Claim 23 recites some elements similar to those recited in claims 1 and 22. As discussed above regarding claims 1 and 22, Amado and Lin fail to teach at least **updating a belief model**. Further, neither Amado, Lin or Golan teach or disclose **adding a stub function to a blackboard**.

As described in Applicant's Appeal Brief, Lin in particular fails to teach (1) an ***expert***; (2) a learning system comprising **truth data files for deducing** beliefs, probabilities and **shadow objects**; (3) **deducing** a set of rules from said learning system; (4) **determining if the output** of [a new] expert **is new**; and (5) **adding the new output's class to said blackboard**.

Golan, as discussed above, uses stub functions, but does not teach adding a stub function to a blackboard. Golan does not teach or disclose a blackboard or any type of expert system. Therefore, the combination of Golan with Amado and Lin does not teach, disclose, or render obvious the elements of claim 23. Claim 23 is therefore allowable, and Applicants respectfully request that the rejection be withdrawn.

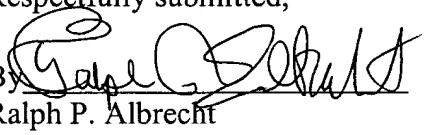
Conclusion

All of the stated grounds of rejection and objection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding rejections and objections and that they be withdrawn. Applicants believe that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is hereby invited to telephone the undersigned at the number provided.

Dated:

April 13, 2005

Respectfully submitted,

By 

Ralph P. Albrecht
Registration No.: 43,466
VENABLE LLP
P.O. Box 34385
Washington, DC 20043-9998
(202) 344-4000
(202) 344-8300 (Fax)
Attorney